A FRAMEWORK FOR COTS SOFTWARE EVALUATION AND SELECTION FOR COTS MISMATCHES HANDLING AND NON-FUNCTIONAL REQUIREMENTS

FERAS HAMED AL-TARAWNEH

DOCTOR OF PHILOSOPHY
UNIVERSITI UTARA MALAYSIA
2014
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Abstrak


Kata kunci: Penilaian perisian Commercial Off-The-Shelf, Pemilihan perisian Commercial Off-The-Shelf, Keperluan bukan kefungsian, Pengendalian ketidaksepadanan, Teori penilaian.
Abstract

The decision to purchase Commercial Off-The-Shelf (COTS) software needs systematic guidelines so that the appropriate COTS software can be selected in order to provide a viable and effective solution to the organizations. However, the existing COTS software evaluation and selection frameworks focus more on functional aspects and do not give adequate attention to accommodate the mismatch between user requirements and COTS software specification, and also integration with non-functional requirements of COTS software. Studies have identified that these two criteria are important in COTS software evaluation and selection. Therefore, this study aims to develop a new framework of COTS software evaluation and selection that focuses on handling COTS software mismatches and integrating the non-functional requirements. The study is conducted using mixed-mode methodology which involves survey and interview. The study is conducted in four main phases: a survey and interview of 63 organizations to identify COTS software evaluation criteria, development of COTS software evaluation and selection framework using Evaluation Theory, development of a new decision making technique by integrating Analytical Hierarchy Process and Gap Analysis to handle COTS software mismatches, and validation of the practicality and reliability of the proposed COTS software Evaluation and Selection Framework (COTS-ESF) using experts’ review, case studies and yardstick validation. This study has developed the COTS-ESF which consists of five categories of evaluation criteria: Quality, Domain, Architecture, Operational Environment and Vendor Reputation. It also provides a decision making technique and a complete process for performing the evaluation and selection of COTS software. The result of this study shows that the evaluated aspects of the framework are feasible and demonstrate their potential and practicality to be applied in the real environment. The contribution of this study straddles both the research and practical perspectives of software evaluation by improving decision making and providing a systematic guidelines for handling issue in purchasing viable COTS software.

Keywords: Commercial Off-The-Shelf evaluation, Commercial Off-The-Shelf selection, Non-functional requirements, Mismatches handling, Evaluation theory.
Acknowledgment

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<th>Description</th>
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<tbody>
<tr>
<td>COTS</td>
<td>Commercial-Off-The-Shelf</td>
</tr>
<tr>
<td>CBS</td>
<td>COTS-Based Systems</td>
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<tr>
<td>CBD</td>
<td>COTS-Based systems Development</td>
</tr>
<tr>
<td>OTSO</td>
<td>Off-The-Shelf Option</td>
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<tr>
<td>PORE</td>
<td>Procurement-Oriented Requirements Engineering</td>
</tr>
<tr>
<td>CSSP</td>
<td>COTS Software Selection Process</td>
</tr>
<tr>
<td>CAP</td>
<td>COTS software Acquisition Process</td>
</tr>
<tr>
<td>PAREMO</td>
<td>Balanced Reuse Model</td>
</tr>
<tr>
<td>MiHOS</td>
<td>Mismatch handling aware COTS Selection</td>
</tr>
<tr>
<td>CRE</td>
<td>COTS-based Requirements Engineering</td>
</tr>
<tr>
<td>STACE</td>
<td>Social-Technical Approach to COTS Evaluation</td>
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<tr>
<td>DC</td>
<td>Developing Country</td>
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<tr>
<td>GUI</td>
<td>Graphic User Interface</td>
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<tr>
<td>IDC</td>
<td>International Data Corporation</td>
</tr>
<tr>
<td>CBA</td>
<td>COTS-based Application</td>
</tr>
<tr>
<td>USC</td>
<td>University of Southern California</td>
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<tr>
<td>TT&amp;C</td>
<td>Telemetry, Tracking, and Control</td>
</tr>
<tr>
<td>CERES</td>
<td>Center for Research Support</td>
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<tr>
<td>WSM</td>
<td>Weighting Scoring Method</td>
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<tr>
<td>AHP</td>
<td>Analytical Hierarchy Process</td>
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<tr>
<td>IusWare</td>
<td>IUStitiasofWAR</td>
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<tr>
<td>CISD</td>
<td>COTS-based Integrated System Development</td>
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<td>PRISM</td>
<td>Portable, Reusable, Integrated Software Model</td>
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<tr>
<td>CEP</td>
<td>Comparative Evaluation Process</td>
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<tr>
<td>CF</td>
<td>Confidence Factor</td>
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<tr>
<td>IESE</td>
<td>Institute for Experimental Software Engineering</td>
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<tr>
<td>RCPER</td>
<td>Requirements-driven COTS Product Evaluation Process</td>
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<td>CARE</td>
<td>COTS-Aware Requirements Engineering</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<td>---------</td>
<td>-------------</td>
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<tr>
<td>PECA</td>
<td>Plan, Establish, Collect, and Analyze</td>
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<tr>
<td>CSCC</td>
<td>Combined Selection of COTS Components</td>
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<td>GCS</td>
<td>General COTS Selection</td>
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<td>unHOS</td>
<td>uncertainty Handling in COTS Selection</td>
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<tr>
<td>GQM</td>
<td>Goal Question Metrics</td>
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<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<tr>
<td>QFD</td>
<td>Quality Function Deployment</td>
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<td>BBN</td>
<td>Bayesian Belief Network</td>
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<td>SPA</td>
<td>Software Process Assessment</td>
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<tr>
<td>MCDM</td>
<td>Multi-Criteria Decision Making</td>
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<td>ERP</td>
<td>Enterprise Resource Planning</td>
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<td>KM</td>
<td>Knowledge Management</td>
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<td>API</td>
<td>Application Programming Interface</td>
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<td>CAR/SA</td>
<td>COTS-Aware Requirements and Software Architecture</td>
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<td>NFR</td>
<td>Non-Functional Requirements</td>
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<td>IRC</td>
<td>Identifying mismatches Resolution Constraints</td>
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<tr>
<td>CRC</td>
<td>Considered Resolution Constraint</td>
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<td>SDMP</td>
<td>Systematic Decision Making Process</td>
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<td>C-QM</td>
<td>COTS-Quality Model</td>
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<tr>
<td>ISO/IEC</td>
<td>International Organization for Standardization and international Electro technical Commission</td>
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<td>UK</td>
<td>Unite Kingdom</td>
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<tr>
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<td>Software Package for Social Sciences</td>
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<td>Joint Application design</td>
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<td>Visual Basic.Net</td>
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<td>SD</td>
<td>Standard Deviation</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>CEC</td>
<td>COTS Evaluation Criteria</td>
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<td>ANC</td>
<td>Average Normalized Column</td>
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<td>CR</td>
<td>Consistency Ratio</td>
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<td>CI</td>
<td>Consistency Index</td>
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<td>RI</td>
<td>Random Index</td>
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<td>FMML</td>
<td>Final Mismatching Level</td>
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<td>ML</td>
<td>Matching Level</td>
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<td>MML</td>
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<tr>
<td>FFS</td>
<td>Final Fitness Score</td>
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<td>WBS</td>
<td>Work Breakdown Structure</td>
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<td>SLA</td>
<td>Service Level Agreement</td>
</tr>
<tr>
<td>DM-PT</td>
<td>Decision Making- Prototyping Tool</td>
</tr>
<tr>
<td>ID</td>
<td>Identification number</td>
</tr>
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<td>COB</td>
<td>College Of Business</td>
</tr>
<tr>
<td>CAS</td>
<td>College of Art and Science</td>
</tr>
<tr>
<td>CLGIS</td>
<td>College of Low, Government, and International Studies</td>
</tr>
<tr>
<td>PCs</td>
<td>Personal Computers</td>
</tr>
<tr>
<td>SMIS</td>
<td>Student Management Information System</td>
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<tr>
<td>OSS</td>
<td>Open Source System</td>
</tr>
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<td>OTS</td>
<td>Off-The-Shelf</td>
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CHAPTER ONE
INTRODUCTION

1.1 Introduction

This chapter provides an introduction to the field of this research by describing the background of the study and discussing the research problem. The research questions are then presented and used to construct the research objectives. Finally, the chapter describes the scope of this research; as well as highlighting the significance of the research. The chapter concludes with an overview of the remaining chapters of this thesis.

1.2 Background

The world of software development has significantly evolved from development-centric to a procurement-centric approach. In other words, this new approach has been introduced as an alternative software development approach which focused on building systems through pre-packaged solutions assembling, usually known as Commercial-Off-The-Shelf (COTS) software, and migrating existing systems towards COTS-Based Systems (CBS) (Gupta et al., 2012). Nowadays, most organizations have decided to change from in-house development towards COTS software integration in order to reduce the maintenance cost, development time, and operating, testing, and validating efforts (Couts & Gerdes, 2010). Thus, COTS software has become strategic and economic way for building large and complex systems.
The contents of the thesis is for internal user only
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